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Fusiform Rust of Southern Pines

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Fusiform rust, caused by the fungus *Cronartium fusiforme* (A. & K.) Hedge & Hunt, is one of the most serious diseases in southern pine forests. This rust kills huge numbers of seedlings and disfigures and weakens the stems of larger trees. It ranges from Maryland to Florida and west to Texas and southern Arkansas, but is most prevalent in the longleaf pine belt and in the southern part of the shortleaf-loblolly-hardwood forest type.

Hosts

Loblolly and slash pines are particularly susceptible to fusiform rust. Pitch and pond pines are also attacked, while longleaf pine is moderately resistant and shortleaf pine highly so. A number of pines exotic to the fusiform-rust area are susceptible.

Oaks are the alternate hosts for the rust. Water, willow, and laurel oaks are most susceptible. Next in susceptibility are bluejack, blackjack, southern red, and turkey oaks. Still other oaks, including some white oaks, are sometimes hosts to the disease.

Pines and oaks of all ages are susceptible. The damage to pine is worst in young stands. On the oaks the rust merely spots the leaves, and does practically no harm.

Symptoms and Life History

Fusiform rust lives from year to year in the living bark of pine

branches and stems, causing galls that are typically spindle shaped (fig. 1, A). Old galls, particularly on slash pine, sometimes die on one side and form flat or depressed cankers that may exude large amounts of resin (fig. 1, B). At least some of this resin exudation is caused by secondary infections of the pitch canker fungus *Fusarium lateritium f. pini*. Cankers weaken the stem so that the tree breaks off easily in high winds (fig. 2).

Occasionally a fusiform-rust gall is ball shaped and difficult to separate from the globose galls of the eastern gall rust (*Cronartium cerebrum*) (fig. 3), which is common on shortleaf, Virginia, sand, and spruce pines and occasionally occurs on loblolly and slash pines. Galls of the eastern rust, however, have distinct "collars" of bark at each end. Eastern gall rust is much less destructive than fusiform rust.

In March or early April powder-like yellow spores are produced on pine cankers. These spores do not reinfect pine but are carried by the wind to young oak leaves. About 10 days later minute yellowish pustules develop on the lower surfaces of the leaves. Spores from these spots infect other oak leaves to greatly multiply the number of rust spots on oak. From April to mid-June, numerous brownish hairlike structures appear on the oak leaf spots (fig. 4). Dozens or even hundreds of these "hairs" may occur on the under side of a single oak



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FIGURE 1.—*Fusiform* rust on southern pines: A, Numerous infections (galls) on loblolly pine; B, large canker on loblolly pine, ruining lower bole.

leaf. On these "hairs" many small, delicate spores (sporidia) develop. These sporidia are carried by wind currents, and some of them infect young pine needles or succulent green growing shoots. Thus the complete infection cycle takes place within a few weeks in the spring. Most pine infection occurs in April. A few months afterward, the tapered swellings of pine stems or branches begin to appear, but infective spores are not produced until the next year.

Thus the rust fungus spreads from pine to oak, oak to oak, and oak to pine, but never from pine to pine. The amount of infection varies from light to heavy from year to year, depending on the weather. Temperatures between 60° and 80° F. and humidity close to the mois-

ture saturation point for a minimum of 18 hours are needed for abundant infections of pine.

Nursery rust infections totaling 10 to 20 percent of all slash and loblolly seedlings have been common; sometimes losses have been 35 to 60 percent. Nursery infections usually occur directly on the stems, and infected stock almost never survives the first year of outplanting. In young slash plantations on high rust-hazard sites, 30 percent mortality, with 60 to 80 percent of the remaining trees having trunk infections, is not rare. To be damaging, an infection must occur on the stem. Branch cankers less than 15 inches from the stem often grow down into the stem, but branch cankers farther out are usually killed by natural pruning of the



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FIGURE 2.—Wind breakage of slash pine at fusiform rust cankers.

branches before they become harmful.

Control

Rust spreads sufficiently far from oak to pine to preclude oak eradication as a practical control measure.

Nursery stock can be protected by weekly spraying with ferbam, ziram, or zineb, at rates of 2 pounds in 75 gallons of spray per acre plus a suitable sticker. More frequent spraying is advisable in wet springs. Spraying must start as soon as the seed begins to germinate and must continue to mid-June, even if this means applying the first sprays to the seedbed cover instead of directly on the seedlings. Because infected seedlings seldom survive outplanting, they should be culled during grading.

Spraying is not economically feasible in plantations and natural stands. Certain practices, however, will reduce rust damage:

Avoid planting slash pine on sites where very high rust infection takes place. Loblolly pine is likely

to survive somewhat better than slash on high rust-hazard sites, but longleaf and shortleaf pines are a much better choice for these sites.

Where local experience shows that rust hazard is moderate, satisfactorily stocked plantations can be secured by using closer spacing than usual to favor rapid natural pruning of laterals and thus lessen the danger of destructive trunk cankers. Close planting also permits greater rust loss without leading to understocking.

Cultivation and fertilizing of planted slash and loblolly pines lead to early breaking of dormancy, which favors higher rust infections. Control measures should be intensified when plantations are cultivated or fertilized in areas with appreciable rust.

Periodic artificial pruning of branches with cankers less than 15 inches from the stem will prevent many trunk infections from developing. Pruning is most beneficial in young plantations, but is useless on trees that already have a trunk canker.

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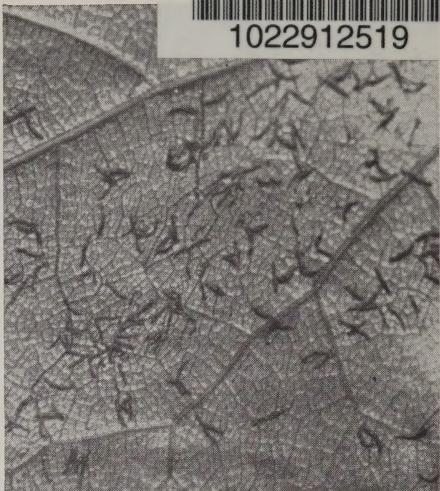


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FIGURE 3.—Swellings on nursery stock indicate infections: A, caused by *Cronartium fusiforme*; B, by *C. cerebrum*. These seedlings will not survive outplanting.

Trees with trunk cankers should be salvaged in thinning, provided their removal does not seriously open the stand beyond that desirable if no rust had occurred. The following rule covers the period of salvageability of trunk-cankered trees: (a) Less than 50 percent of circumference killed—more than an even chance of salvage for 8 years, (b) 50 percent of circumference killed but no bend in stem at canker or sunken canker face—an even chance of salvage for 5 years, (c) 50 percent of circumference killed, with a bend at canker and either a normal or sunken canker face—less than even chance of salvage for 5 years.

Eventually seed from orchards of rust-resistant loblolly and slash or of hybrid origin may be available for general planting.



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FIGURE 4.—These hairlike structures on underside of oak leaf produce the spores that infect pines. In this stage, fusiform rust cannot be separated easily from several other rust fungi.

CAUTION: Ferbam, ziram, and zineb are mild poisons. In handling them follow directions and heed precautions given on the container.

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